AMERICAN

RAILROAD JOURNAL,

AND

MECHANICS' MAGAZINE.

Published Monthly at 23 Chambers-st. New York, at $2 a-year, in advance, or 3 copies for $5.

By GEO. C. SCHAEFFER, and D. K. MINOR, Editors.

No. 11, Vol. I. Third Series.

NOVEMBER, 1843.

Whole No. 430. Vol. XVI.

For the American Railroad Journal and Mechanics' Magazine.

AMERICAN MANUFACTURE OF WIRE ROPES FOR INCLINED PLANES, STANDING RIGGING, MINES, TILLERS, ETC. BY JOHN A. ROEBLING, CIVIL ENGINEER.

The art of manufacturing ropes of *wire* is comparatively new. Numerous attempts have been made in Europe and here, and most of them have proved failures. A collection of parallel wires, bound together by wrappings in the manner of a suspension cable, is no rope and not fit for running, it can only be used for a stationary purpose. The first rigging made in England, was of this description. The difficulty in the formation of wire rope arises from the unyielding nature of the material; iron fibres cannot be twisted like hemp, cotton or wollen; their texture would be injured by the attempt. To remove this obstacle, some manufacturers have resorted to *annealing*, and thereby destroyed the most valuable properties of iron wire, viz. its great strength and elasticity.

My first attempts in the manufacture of wire rope, were made four years ago, my intimacy with the construction of wire cable bridges induced me to investigate this matter. The principles of my process differ from those of the English manufacturers, they are original and secured by patent. The novelty of my proceeding chiefly consists in the spiral laying of the wires around a common axis *without twisting the fibres*, and secondly in subjecting the individual wires while thus laying to a uniform and forcible tension under all circumstances. By this method, the greatest strength is obtained by the least amount of material, and at the same time a high degree of pliability. Each individual wire occupies exactly the same position

NOTE.—By the term elasticity, I mean the property of wire to stretch and give when subjected to a strain, and to resume its former length after the strain ceases, without suffering a permanent elongation. The extent of elongation of iron is in proportion to the tension. In estimating the strength of a rope, the strain it has to support, should never exceed the limit of elasticity. A permanent strain requires some more allowance.

The elongation of good wire of No. 14, 15 or 16, amounts, according to my own experiments to $\frac{1}{8000}$ of its length per ton per square inch. A strain of 15 tons upon a rope of 1 square inch section and 1000 feet long will produce an elongation of 3 feet. The limit of elasticity for working rope I have assumed at 15 to 20 tons per square inch, according to the size and quality of the wire. A greater strain will produce permanent elongation, and if repeated, at last a rupture.

throughout the length of a strand; another result of the precision and force applied in laying, is the close contact of the wires, which renders the admission of air and moisture impossible.

Three years ago I offered to the board of canal commissioners which was then in power in Pennsylvania, to put a wire rope of my manufacture on one of the planes of the Allegheny Portage railroad, at my own risk and expense, the value of the rope to be paid in proportion, as it rendered services equivalent to a hemp rope. This liberal offer however was rejected and not considered until the present board came into office. Last year I put three ropes, measuring in the aggregate 3400 feet, 4½ inches circumference, in operation on plane No. 3. Owing to the want of adhesion, I had at the start to contend with some difficulties. By means of a double groove on the receiving sheave and a guide sheave placed back of it, which crosses the rope and leads it from one groove to the other, which improvements were added to the machinery last winter; I succeeded in doubling the adhesion. When in unfavorable weather there is delay and slipping on the other planes the wire rope can at all times pull as heavy a load *without* a balance, as the engine is capable of hauling. The planes of the Portage railroad require hemp ropes of 8½ inches circumference, made of the best Russia or Italian hemp, and which cannot be trusted longer with safety than one season. They are frequently from reasons of economy continued 1¼ seasons; much however, depends upon the weather and business. The unfavorable circumstances under which the wire rope had to work last year, effected it some; the wear of the whole of this season, however, is not perceptible, and its present condition promises a long duration. I am now manufacturing another wire rope of 5100 feet long in four pieces for plane No. 10.

The first rope of my make, 600 feet long, 3¼ inches circumference has now been in successful operation two seasons, hauling section boats from the basin to the railroad at Johnstown. Two more were put to work last spring at the new slips at Hallidaysburg and Columbia. From my present experience, I may safely assert that *wire rope* deserves the preference over *hemp rope* in all situations much exposed, and where great strength and durability is required.

By my process of manufacture, the same pliability is imparted to the rope which is proper to the wire itself. Paradox as this may appear, it is nevertheless a fact and is easily explained. By pliability is here understood the extent of flexure to which the rope or wire may be subjected, without producing a permanent bend; when released the rope must resume its former and straight position. To bend a rope requires force, and this force is in proportion to its areal section, *caeteris paribus.*

Well manufactured *iron rope* is *more* pliable than *hemp rope* of the same strength. I am manufacturing tillers of fine wire, capable of bearing 3000 lbs. and which ply around cylinders as small as four inches in diameter, and in which the wires are so compactly laid, that not the slightest shifting in their spiral position is to be observed. A number of my tillers are in use

on the Ohio and Mississippi. Such rope would be pliable enough for running rigging and be of long duration.

I will here add a few remarks on the introduction of *standing wire rigging* in place of *hemp rigging*. This subject has for some years passed, engaged the attention of the navy department of England and France, and the success which has attended the use of wire in place of hemp for shrouds and stays in the naval and commercial service of Great Britain, would, it appears, seem to warrant an attempt to test its utility on our national vessels.

Allow me to cite here a few remarks from the notes of Capt. Basil Hall, on a tour through Switzerland, and while examining the wire suspension bridge at Fryburg. He says, "attempts are now making and will ere long succeed, to introduce wire rigging, which is stronger and better than *chain*, because less dependent on the accidental quality and careless manufacture of a single part. How strange it is, that the plan of making *wire bridges*, so successfully adopted in France, and elsewhere, should not have found favor enough in England to be fairly tried on a large scale. Fryburg-bridge 301 feet *wider* than Menai, at least equally strong, has cost only one-fifth of the money. I do not think wire will answer for running rope; but for standing rigging it may, I conceive, be most usefully substituted for hemp, for with equal strength experience shows it to be lighter."

The cables of suspension bridges are stationary and will, when protected against oxidation, last an indefinite period. Standing rigging, (when compared to running rope) is nearly stationary, and there is little wear but what arises from the direct strain, which *if* supported by sufficient strength, will have no deteriorating effect. In comparing the two materials, wire and hemp for rigging, the state of preservation and time of use should be considered. For instance, a hemp stay of a certain size, made of the best Italian hemp, will when new, possess two-thirds of the strength of a wire stay of the same weight per foot; but let the two stays have been exposed and served five years, then the strength of the hemp stay will be gone, while the wire stay will not show any perceptible reduction. In this case, of course, a common wear and tear is supposed.

The most prominent features of wire rigging as compared to hemp rigging, are its great durability, less weight and size, less surface exposed to wind, less danger in time of action of being destroyed by shot. Another good quality of the wire rope is its great elasticity which is quite sufficient to counteract the effect of a sudden jerk, while a vessel is rolling heavily at sea. The elasticity of hemp rigging is only to be relied on to a very small extent, it will give and stretch a great deal but not return.

A common objection of those not familiar with the nature of wire rope, is its supposed rapid destruction by oxidation, but no apprehension is less founded than this. Running wire rope while in use either in or out of water, in mines or any other situation, will not even require the protection of oil, varnish or tar; while at work it will rust no more than a rail or a chain in use, but when idle, oxidation will affect it in proportion to the surface expo-

sed. As, however, the process of laying is carried on with mathematical precision, by which the wires are brought into the closest contact, the assemblage of wires in form of a strand, present a solid rod, which will be no more subjected to rusting than the link of a chain of the same size. The individual wires as well as the strands and ropes are coated with an excellent varnish during the manufacture. Wire rigging will require no other protection but oiling or tarring once or twice a season. Where elegance is an object, black or green paint may be used. Rigging made of zinked wires and not painted, would present a most elegant appearance and be exempt from all rusting.

Wire rope can be spliced in the same manner as hemp rope. The attachment of wire shrouds to the sides of the vessel and to the masthead and their connection with the rattlines (which should also be of wire) can be effected by the old method; the use of wire however, will suggest some modifications better adapted to the material.

Some wire rigging has been manufactured in England which simply consists of a collection of parallel wires bound together and served over with hemp. These mixtures, as experience has proved in the case of tiller-ropes, are objectionable, the wire will rust inside of the hemp in spite of all protection by varnish; besides the cover of hemp, which adds nothing to the strength, is only an additional expense.

Iron is now gradually superseding wood in the construction of vessels, a complete revolution in ship building has already commenced in England. Although very expensive at first, iron ships will prove the cheapest in the end. Are there any well founded objections to wire rigging, which assumes the same relation to hemp rigging as wooden ships to iron ones? There are none. Why then not test this matter by encouraging those who are capable of bringing it to perfection? A number of iron vessels are now building for the naval and revenue service, which seem to offer appropriate occasions for the test of this matter.

Saxonburg, Pa., Sept. 1843.

ACCIDENTS UPON RAILROADS.

Messrs. Editors:—In a previous paper I adverted to the essential change worked in the system of highway police by the introduction of railroads, and the application of steam power to vehicles on land; and pointed out the necessity of correspondent regulations for the safety and protection of such as have occasion to use these new improvements. I think the subject cannot be too earnestly pressed upon the attention of those who have the power and whose duty it consequently is to deal with it.

It is foreign from my present purpose to advert to the ultimate effect which the new and wonderful power now in successful operation is destined to produce upon all the relations of trade and of society at large; but it may well be supposed that the suddenness with which the invention came upon the public, and the extraordinary results that immediately attended it, prevented the proper attention to the means more particularly calculated to insure safety in its practical operation.

In the prosecution of these improvements the United States and England

took the lead; and though in both countries the common high road was rapidly superseded by an agent of such vast power for good or ill, some time elapsed before the authorities of either appeared aware of the necessity of appropriate regulations adapted to this new species of communication. This branch of the subject first attracted the attention of the government in England.

In the year 1838 the reports of "commissioners appointed to consider and recommend a general system of railways for Ireland," was presented by the command of the Queen, to both houses of parliament; and in these the dangers of railroad travelling, as compared with that on the common highway, and also the means which had already been provided against the former, are particularly considered.

The reports were subjected to the fullest discussion by some of the ablest writers in England, and I cannot do better than devote the most of this article to a quotation from one of the best papers to which the investigation gave rise. The reader will be thereby better enabled to appreciate the observations I have already submitted, and those which I may hereafter make.

It will be perceived from the facts stated in the quotation, that the rigorous exclusion of cattle from the track is part of the means resorted to in England to guard against the dangers upon railroads, and that to this precaution the extraordinary safety which has attended them may be mainly attributed.

The writer is treating of those parts of the reports relating to the dangers attendant upon the old and new description of roads, and, after many pertinent observations upon the advantages of the extraordinary velocity with which passengers and heavy goods are transported upon railroads, he proceeds as follows:

"The dangers of travelling in either fashion may be divided into four heads, namely:

1. The dangers of the road.
2. The dangers of the carriage.
3. The dangers of the locomotive power.
4. The dangers arising from momentum, or from the weight of burden, multiplied by the velocity at which it is conveyed.

"As regards the first of these, we are certainly humbly of opinion that *cæteris paribus*, a railway must be less dangerous than a high road; because it is flat instead of hilly; because a surface of iron is smoother than a surface even of broken stones; because the lip of the rail which confines the wheels is an extra security which the common road does not possess; and because wagons, vans, carts, private carriages, and all other vehicles, *as well as horses and cattle, belonging to the public, are rigorously excluded.*

"As regards the second of these dangers, we submit to our readers that *cæteris paribus*, a railway car must be less dangerous than a stage or mail coach, because its centre of gravity, when empty, is low instead of high; because its passengers sit low instead of high, inside and not outside—because its axles, receiving no jerks, are less liable to break—and consequently because altogether it is less liable to overset.

"As regards the third of these dangers, we conceive there can be no doubt whatever, that, *cæteris paribus*, a locomotive engine must be less dangerous than four horses, because it is not liable to run away, tumble down, or shy at strange objects or noises—because it has no vice in it—because it is not, like a horse, retained and guided by numberless straps and buckles, the breaking of any one of which would make it take fright. And lastly, because, by the opening of a valve, its restless enterprizing spirit can, at any

moment, be turned adrift, leaving nothing behind it but a dull, harmless, empty copper vessel.

"It is true that it is possible for the boiler to explode, yet as the safety-valve is the line of least resistance, that accident with mathematical certainty can be so easily provided against, that it is not now apprehended; and even if, contrary to philosophical calculations, it should happen, the sudden annihilation of the locomotive power would injure scarcely any but those firemen or engine drivers answerable to the public for their neglect which had occasioned the misfortune, while to the great bulk of the passengers, it would create no inconvenience except a gradual halt of the train.

"With respect to the fourth of these dangers, it must be admitted, that both the speed and weight of a railway train are infinitely greater than the momentum of a mail or stage coach; yet, if the latter, in case of serious accidents, be sufficient to cause the death of the passengers, it might be suggested that the former can do no more; just as it is practically argued by old soldiers, when they rebuke recruits for dreading artillery, that a musket ball kills a man as dead as a cannon shot. If a railway train, at full speed were to run against the solid brick work of the tunnel, or to go over one of the steep embankments, the effect would mechanically be infinitely greater, but perhaps not more fatal to the passengers, than if the mail at its common pace, were to do the same; besides which, it must always be remembered, that though the stage may profess to travel at the safe lukewarm pace of eight miles an hour, yet any accident suddenly accelerates or boils up its speed to that of the railroad, under which circumstance the carriage is ungovernable. In going down a hill, if a link of the pole-chain break—if the reins snap—or if the tongue of a little buckle bends, the scared cattle run away—and it is this catastrophe, it is the latent passion, and not the ordinary appearance of the horses, which should be fairly considered, when a comparison is made between railroad and common road travelling; for surely there is infinitely less danger in riding a horse that obeys the bridle at twenty miles an hour, than there is sitting demurely trotting, at the rate of eight miles an hour, on a runaway brute that is only waiting for the shade of the shadow of an excuse to place his rider in a predicament almost as unenviable as Mazeppa's.

"There is nothing, we understand, at all either dangerous or disagreeable in going what is vulgarly termed "fast," if no object intervenes mechanically to oppose the progress. Now we have already shown that the obstructions which exist on a railroad are infinitely less than those which exist on a high road, inasmuch as from the former *every human being, animal and vehicle is excluded, excepting those safely included in the train.*

"So much for theory; in practice the precise amount of the danger of railroad travelling, even at the commencement of the experiment, will at once appear, from the following official reports, to have been about *ten passengers* killed out of more than *forty-four millions!* [See opposite page.]

Now, in England the average speed upon railroads is at least thirty miles per hour, and from the foregoing observations we think every one will be struck with the miraculous safety with which, with such an extraordinary degree of velocity, railroads have transported so many millions of human beings! When the reader reflects that this safety is chiefly attributable to those rigorous measures by which cattle—the most common cause of obstruction—are excluded from the English roads, he will be apt to inquire whether similar preventives be not equally called for, and should not be adopted in this country.—*Balt. American.* T.

Names of railways.	Date. From	Date. To	Number of miles.	Number of passengers.	Number of accidents.
London and Birmingham,	July 20, 1837,	Nov. 5, 1838,	19,119,465	541,360	3 cases of contusion, no death, (1.)
Grand Junction,	July 4, 1837,	June 10, 1838,		214,064	2 cases of slight do. do. (2.)
Bolton and Leigh and Kenyon and Leigh,	June 13, 1831,	October 1, 1838,	3,923,012	508,763	2 deaths, 3 slight contusions, (3.)
Newcastle and Carlisle,	March 9, 1835,	October 1, 1838,		8,540,759	5 deaths, 4 fractures, (4.)
Edinburgh and Dalkeith,	Summer of 1832,	Sept. 30, 1838,		1,557,642	1 arm broken, (5.)
Stockton and Darlington,	October 10, 1832,	October 10, 1838,	2,213,681	357,205	None.
Great Western,	June 4, 1838,	Nov. —, 1838,	4,109,538	230,408	None.
Liverpool and Manchester,	Sept. 10, 1830,	Sept. 28, 1838,		3,524,820	8 deaths, no fractures, (6.)
Dublin and Kingston,	Nov. 14, 1836,	Sept. 1, 1838,		26,410,152	5 deaths and 3 contusions to passengers.
London and Greenwich,	Dec. 14, 1836,	Nov. 5, 1838,	484,000	2,880,417	1 passenger slightly bruised.

1. None of these accidents occurred to actual passengers.
2. None of these accidents occurred to actual passengers.
3. None of the persons killed were passengers.
4. One of the persons killed was a passenger.
6. The whole of these were passengers; one of them, a sergeant in charge of a deserter, who jumped off the carriage while in motion. The serjeant jumped after him to retake him, but was so much injured that he died; 3 others got out and walked on the road, and were killed; the rest suffered by collision of two trains, at different times. These include all the casualties from the very commencement of the working of the line."

Railway and Common road Travelling.—The Paris papers contain advertisements of diligences which leave Paris daily for the southwestern parts of France—Tours, Bordeaux, etc., by the Orleans railway. These diligences proceed upon the railway to Orleans, a distance of about 80 miles, and on their arrival are immediately transferred, without unloading of either passengers or baggage, to wheels and vehicles drawn by horses ready harnessed, and the journey is continued upon the common roads. On the arrival of these vehicles at the railroad from the south they are separated from the wheels, and without any disturbance of the passengers are transferred to the truck provided for it, and attached to the locomotive train, and the journey is thus continued to its termination. To facilitate this operation a machine for transferring the carriage from one set of wheels to

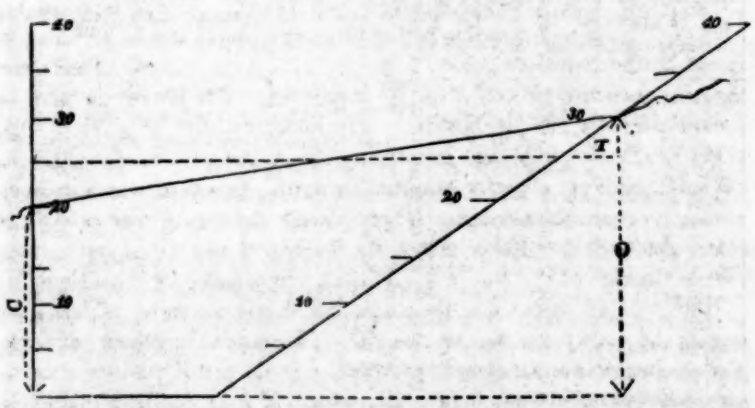
the other has been invented by M. Arnoux, which war first introduced, and as we learn with entire success, on the Orleans railway on the 10th June. The number of passengers on the line of the Orleans railroad in the month of June was 50,329, and the amount received for passengers, post chaises, horses, merchandize, etc., was 320,417 francs. On the same railroad to Corbeil, in addition to those on the Orleans line, the number of passengers in June was 74,420, receipts from all sources 114,505 francs; total of passengers in the month 124,749; receipts 434,922 francs.

NOTES ON PRACTICAL ENGINEERING.—NO. 2.

Cubical Quantities.

In preliminary surveys the object is to determine from the levels of the centre line the quantities of excavation and embankment to such a degree of accuracy, as to give a fair view of the absolute cost and also of the relative merits of the rival lines. Where there is no transverse slope the degree of accuracy is limited only by the number of levels in a given distance and the calculation is as easy and expeditious as can be desired.

When the ground slopes transversely, the inclination is taken by the level and rod or by the slope instrument. In the great majority of cases the latter will be the more convenient method. Having the centre levels and the slope on each side, we are prepared to calculate the cubic content, on the assumption that the surface of the ground is even from the centre to the point where the cutting or embankment runs out. It is not intended here to examine the merits of various modes of finding these quantities, whether by tables or by a graphical process, but to suggest a combination of the two which appears to offer some advantages in hill-side work.



Draw a half section of cutting, as in the wood cut, to a scale of about half an inch to the foot, on which the divisions at centre and on the slope may be distinctly marked to tenths of a foot; though two tenths would be near enough in practice. If the inclination be taken in degrees, then with a protractor and with a thread at the given angle over the centre cutting we have the point where the slope cuts the surface of the ground and of course

the depth O. The half sum of these depths in a table of level cutting will give a quantity too great by a triangular prism T, having its altitude equal to ½(O—C) and for its base ½(O—C)r.

Example. Depth of cutting at centre 20 feet, half width of base 20 feet, slope 1½ to 1 and depth at outside stake determined as above, 30 feet; required the cubic content per 100 feet.

(20+30) per table of level cutting = 3,588 cub. yds. per ch.
(30—20) per Mr. Johnson's table of prisms = 69·4

Content = 3,518·6 cub. yds. per. ch.

omitting the correction for longitudinal slope as is usual in preliminary surveys. This plan of approximating the cubical contents requires, in addition to the ordinary tables, merely a table of triangular prisms and a half section of cutting and embankment. For the latter it is only requisite to erect a perpendicular at the proper point between the centre of cutting and the slope, when the slopes are equal; if unequal a separate diagram may be used.

In place of taking the transverse inclination of the ground in degrees it may be taken in "feet rise" in a given distance—say the half width of roadway—then the following plan may be adopted.

Mark on the vertical line of centre cutting not only the depths, but also the cubic yards per chain due to those depths and draw horizontal lines from the centre to the slope at each division. Then the centre cutting and rise in half breadth being given, place the edge of a graduated rule on these two points—the zero over the centre cutting. The point where the edge of the rule crosses the slope determines of course, the height O; the half distance between these points will be on the horizontal line on which is marked the cubic content per chain due to a depth = ½ (C+O). The divisions on the edge of the rule will give this half distance at a glance, and, to prevent confusion, the horizontal lines may be drawn in different colors. This quantity will therefore be called off by inspection. The correction may be determined in a similar manner. Graduate the edge of a short rule to the same scale as the line of centre cutting, but mark on the divisions the cubic yards per chain contained in triangular prisms of which these divisions represent the altitudes. Then, placing the zero of this rule at the centre cutting, the division where the horizontal line, determined above, crosses the edge of this rule will give the correction also by inspection.

It frequently happens that the choice lies among a number of lines connecting the same points and not materially differing in the quantity of earthwork. In such cases a close approximation to the actual quantity is necessary, and the calculations become laborious. It is for the reader to decide whether the methods suggested in these notes compare favorably or otherwise with his own practice. If the latter, he will perhaps make his views known through the columns of the Journal.

The following table may be useful in some cases of earth-work and masonry. It gives the correction per cent. to be deducted from the average of the bases of frustrums of pyramids or, which is the same thing, from the

half sum of the solid contents of two triangular prisms erected on these bases. Suppose D and d to represent the end areas of a frustrum of a pyramid whose altitude is 1, then the solid content will be $\frac{1}{3}(D+d+\sqrt{Dd})$; but by averaging the end areas it will be $\frac{1}{2}(D+d)$. Table II gives the deduction per cent. to be made from $\frac{1}{2}(D+d)$ to give the true content.

TABLE II.

$$\left\{\frac{D+d}{2}-\frac{D+d+\sqrt{Dd}}{3}\right\}\frac{100}{\frac{1}{2}(D+d)}$$

d \ D	2	3	4	5	6	7	8	9	10
1	1·90	4·46	6·67	8·49	10·0	11·28	12·40	13·33	14·15
2		·67	1·90	3·22	4·46	5·62	6·67	7·62	8·49
3			·34	1·06	1·90	2·78	3·64	4·46	5·23
4				·20	·67	1·26	1·90	2·56	3·22
5					·14	·46	·90	1·39	1·90
6						·10	·34	·67	1·06
7							·07	·26	·52
8								·06	·20
9									·05

W. R. C.

THE LONG ISLAND RAILROAD COMPANY *vs.* LUTHER LOPER.

This was a resort of the L. I. railroad company, to the legal course in case of a disagreement as to the value of property taken for the use of the company. On application to the vice chancellor, three appraisers were named and accepted by the parties, notices were issued and a day appointed by the appraisers to view the premises and hear such evidence as the parties might choose to offer in reference to value, damage, etc. The appraisers met according to appointment, and the parties appeared with their witnesses, J. R. Lott, Esq. being counsel for Loper, and the company being represented by their president and two directors.

The president of the company offered the map and profile of the ground taken, and the appraisers proceeded to view the land as staked out. The counsel for Mr. Loper then claimed that his client was entitled to receive, 1st, the full value of the land, stated to be $75 per acre, and 2d, a sufficient sum of money to build and maintain a fence on each side of the road for the duration of the charter, and a further compensation for the grain and grass destroyed in the construction of the road. To establish his position several witnesses were called, who testified that the whole farm taken together was worth $50 per acre; that the portion taken for the railroad was worth $60 per acre where the ground was cleared, and $10 per acre where covered with wood; one witness considered the railroad a damage to the farm, and another that it was worth about as much as before, and that the fencing was worth seven shillings [87½ cents] per panel of 12 feet. The testimony of other witnesses on the same side to the same facts was also taken, and the counsel here rested his case.

The president then opened the case on the part of the company, by giving a general statement of the business and condition of the road with a view of showing its operation upon the interests of the landholders, which he claimed was in every case beneficial; he submitted to the commission whether it was just that a party benefitted to the amount of some hundreds of dollars should come forward and claim of the party conferring the favor, a large sum because he himself was not quite so much benefitted as his neighbor through whose land the line did not happen to be located; he could not persuade himself that the commission would be willing to adopt the principle that because some of Mr. Loper's neighbors were benefitted $1000 and Mr. Loper but $500 that therefore the company should pay him, Loper, the difference. And finally, on the part of the company the ground was taken, that the spirit as well as the letter of the statute, required the commission to consider whether the whole farm was worth more or less by the occupation of a portion of it by their road, and he contended that in case he could show as he hoped to do, to the satisfaction of the commission that the land was actually more valuable than before, they were bound to adjudge that there was no damage done; that the term compensation used in the charter could not by a fair construction be limited to a payment in money, but embraced all the advantages in any way connected with the road and that any rise in the value of the property was actually a compensation for the damage as if the same amount was actually paid in money, or any facility in transportation of produce or manure or saving in time, were actually a portion of the compensation required by the statute. In support of this position he cites several cases where railroads, turnpikes and common roads had been established on the same ground, and also the universal custom in cities of assessing benefits and advantages as well as allowing for damages when they occurred, and he contended that these were all parallel cases except that the company's charter gave them no privilege as to the assessment of benefits on those whose lands were not immediately occupied by the company, and confined tham solely to the question of damage. He considered it a monstrous perversion of law as well as of common sense to allow a man to be entitled to damage, when the property in question was actually increased in value 50 per cent. by the very parties to whom damage was attempted to be charged. Witnesses were then called who reside along the line of road, to show the advantages they derived from the road in their farming operations, but their evidence was objected to as irrelevant, and witnesses were then called to show what had been the value of the land previous to the location of the road. They testified that Loper gave about $30 per acre for the farm with good buildings, that the ordinary price for cleared land was $20 to $25 per acre, and for wooded land $2 to $5, and several witnesses testified that they considered his land worth from $300 to $400 more on account of the facility of sending his produce, wood, etc., to market, and obtaining a return of manure at the company's prices.

In reference to the fencing, it was contended on the part of the company,

that cattle guards at the cross fences were sufficient, and that no fences were needed to make the road safe; a model of the guards used on the road was exhibited and several witnesses examined as to their effect in protecting the landowner, and here the testimony on the part of the company closed.

The counsel for Loper in reply denied the position that the benefits conferred were to be at all considered, and contended that the legislature had in every case where such a course was intended introduced a specific clause to that effect; that the commission were bound to consider the damage only, without reference to any prospective benefit; that the term compensation signified a payment of a specific sum of money and that any other definition was inconsistent with its usual meaning and with the decisions of the courts in similar cases. He contended that the admission of the principle of offset in these cases would be opening a wide door for all kinds of speculative enterprizes, and that the commission were bound to repudiate such a construction of the law, in justice to the community as well as Mr. Loper. That the similarity supposed in this case to that of city corporations did not exist, and that the omission in the charter to specify the assessment of benefits on other than the owners of lands occupied by the company was sufficient to show that such was not their intention in reference to the owner himself for it would result in great injustice if one man was to be taxed for the benefit of his neighbors and that too, without his consent, while they enjoyed the advantages without contributing a farthing; and finally he cited several cases from Wendal's reports, particularly that of the Mohawk and Hudson railroad company *vs.* Bloodgood, to show the law in reference to fencing, declaring that although he supposed the cattle guards might be some security he considered a fence necessary to the perfect security of the landholder.

The commission decided that the land was worth $10·25 per acre, and that Mr. Loper if he chose to erect a fence on one side through his cleared land should have 70 cents per panel of 12 feet for making and maintaining the same.

NOTE.—Since the above case the vice chancellor, in a case reported for and printed in this Journal, decided that no fences were necessary. See Long Island railroad company vs. A. M'Conochie. I have given a sketch of the proceedings because they present what I conceive to be the true ground to be taken in similar cases where amounts are claimed from companies under the name of damages, which should rather be termed a fine for conferring benefits, inasmuch as the amount claimed is generally in exact proportion to the advantages conferred. I believe that the commissioners of public works in most of the United States adopt the principle of offset is estimating damages and I cannot see why the principle should not be followed out in similar cases.

Tolls and Trade of the Canals.—The amount of flour and wheat arrived at the Albany office during the 2d week in October, was flour 57,838 bbls., wheat, 5,674 bush. Making an aggregate of 58,970 barrels. The amount of merchandize cleared from this office during the same time amounted to 2,998,100 lbs.

Tolls during the same week, amounted to $8,953 52. There is a slight falling off in the receipts of tolls and the shipments of merchandize from the first week, but the arrivals of flour exceed those of the first week in October, by 3,946 barrels.—*Albany Argus.*

Being a party referred to in the communication of Mr. Latrobe, propriety forbids that we should say more, at present than that we commend it to the earnest attention of our readers as containing the outlines of a plan which appears to be in some form or other regarded by most of the Profession as the only feasible and acceptable mode of producing a union of the Profession of Civil Engineers.

For the American Railroad Journal and Mechanics' Magazine.

It is known to most of the Profession throughout the United States, that in the year 1839, an attempt was made to establish "an American Society of Civil Engineers." A convention, having this object in view, assembled at Baltimore in February of that year, and the measures then adopted seemed as conducive to the end proposed as could have been devised, and were carried faithfully into effect by the officers entrusted with their execution. The project, however, failed, as had been predicted by those unfriendly or indifferent to it, and feared by its advocates and supporters. The causes of the failure were obviously to be seen—in the wide space over which the members of the institution would have been scattered, rendering their meetings inconvenient and expensive—in the sectional feeling attendant upon the division of the country by the boundaries of distinct States, each having its own capital and uniting its own body of Engineers by a local esprit de corps; and again in the difficulty of satisfactorily adjusting the appointments to office in the organization and government of the society.

The attempt to establish a *National* society having thus failed under circumstances which discouraged its repetition, it may have occurred to some that each State might have a distinct society for itself, or that several contiguous States might unite in the formation of one; thus, in the latter case, dividing the Union into groups of States for the purpose. To the first of these plans the objection is that only a few of the larger States are likely ever to possess, at one time, within their limits a sufficient number of Civil Engineers to support such an institution; and that in the composition of this limited number, changes will be frequent, owing to the constant emigration of the members from one State to another. The same difficulty exists though in a less degree in the partial confederation of neighboring States; and indeed it is manifest that any extent of territory less than the whole country must contract the jurisdiction of such an institution, very much to the disadvantage of the objects it is designed to promote. If independant or associated State societies were however formed and found to operate well within their own boundaries, there must still be some means employed to connect their separate action, so as to maintain a mutual intercommunication between them, in order that the individual proceedings of each might enure to the common benefit of the whole—and this federative connection would be as essential to the advancement of their common objects, as our general government is to the promotion of the general welfare of the republic of which we are the citizens. This correspondence between the State societies would, for the most part be epistolary, and carried on through their officers; for, the

members at large of the several bodies could no better afford to mingle interchangeably in the meetings of their respective assemblies, than they could come together in the general convention of a National Institute—and intercourse could not be kept up by *delegations*, either with convenience to the deputies or general advantage to their constituents. So then, it would appear that pen, ink, paper and the mails must, at last, be the grand medium of communication among the Profession.* Why, then, not take to it at once without a resort to societies difficult to form, expensive to maintain and after all inefficient in their operation?

To the abortive plan of one or more "societies," this interogation presents, as the conclusion following the preceding premises, a very obvious alternative, and one which the Profession has been all along practically employing. Engineers who want information from each other and cannot get it by talking, do it by writing. The improvement by which this most familiar mode of intercommunication is susceptible, and which it is much in need of, is a more general diffusion of its advantages by the introduction of that *system* without which nothing of an associative character can flourish. And of what should this system consist? Of nothing more than this; that a reservoir should be provided into which by the conduits already existing in the mails of the country, every individual of the Profession who has so much as a drop of professional knowledge, may cause it to flow; or, in plain terms, that a Journal should be established as the general organ of the fraternity, to which every one of its members should regard it an imperative duty to contribute paragraphs or pages as his ability and opportunities may permit.

Now there are already several publications founded and maintained for this very object; so that this part of the scheme is no more new than the other, and all that I pretend to, is to point out the capability of this plain, cheap, and long though imperfectly used mode of correspondence to effect nearly all that such a society as was originally contemplated could have accomplished. If I succeed in this I shall, it is true, deserve no more credit than Dr. Franklin merited, when he proved to the Parisians that the sun rose at such an hour and gave light as soon as he was up—but with this I shall be satisfied if the consequences of the demonstration be what I desire.

That an epistolary association of Engineers may become an efficient means of professional intercourse, the following requisites are indispensible.

There, first of all, must be aroused and kept alive in its members, an ardent desire for the advancement of the interests of the Profession in the acquisition and diffusion of science, experience and skill: an active esprit de corps in our ranks, leading to strenuous and united efforts to raise our character as a liberal profession *in our relations to the other professions.* A generous emulation among ourselves individually, entirely free from bitter personal rivalry. The suppression of a hypercritical temper in regard to the *literary* merits of the articles which may appear in our Journal, the substantial information conveyed being looked at *through* the style of its communication

however inelegant that may be, always provided it be sufficiently perspicuous. The best practical Engineers are not always the best writers, and as there is so much of the *mechanical* in our pursuits, we should encourage free communications from those whose calling is entirely of that kind; but who might, if their compositions were too severely criticised, be deterred from giving us the benefit of their knowledge.

To keep under the sensitiveness to be found fault with, which leads to so much personal retort and acrimony in the discussions which figure in professional Journals. We should not wince at criticism however condemnatory, provided it be fair and free from an unkind and caustic spirit.

Sectional and State jealousies, which we all know to have heretofore excited in no inconsiderable degree, must be suppressed, and the whole United States be regarded as our common country. The promotion of national feeling is of prime importance to our object, as it disposes one State to borrow more freely from another whatever may be found of superior merit.

A spirit of frank inquiry into the practice of others, in regard to modes of construction of works and their management, should be promoted; so that no Engineer who has a work to do, or a system of management of a finished work to organize should fail to acquaint himself with the methods used by others in analogous cases. The ambition to be different from all others in our way of doing things is too prevalent. It is a spirit more pardonable than wise; but as it will continue to possess us, the way to gratify it and secure originality in our own productions, is to know all that others have done before us in that department.

Untiring *industry* in collecting and communicating every species of professional information within our reach. We should avail of every opportunity of noting down the facts falling in our way (however comparatively trivial) bearing upon professional principles. These observations should be transmitted to the Journal at our earliest leisure. And in regard to this most meaning word *leisure*, it is necessary that right ideas should be entertained, as wrong ones are so prevalent. The Engineer who waits for entire cessation from professional occupation and care to record his experience for the benefit of others will wait in vain, and do nothing for them after all. Leisure will never come to him even if employment should cease. That suspension of labor generally brings with it a loss of active interest in the concerns of the profession, and the procrastination which prompts him to postpone until an idle hour, his note or his contribution to the Journal founded upon it, will in a majority of cases put off the making of it altogether. The undersigned frankly avows that he speaks in this matter from personal experience.

The Engineer should not wait until he actually and immediately wants information upon certain points; but if anything should occur to make him sensible of the advantage of eliciting, for the common benefit, the experience which may exist in regard to such points, he should at once pro pound in writing a series of queries, and forward them to the Journal, ad

dressed to the Profession at large, and calling for answers, which should be promptly given by those who can furnish them.

The information thus asked for should be as *detailed* as possible—vague and general accounts of works are mostly unsatisfactory and of no practical utility. We want to be saved the labor of studying out for ourselves what has been already and successfully carried into effect by others, so that, in all that we do to advance the art of Engineering, our first step may be planted in the last foot print of him who preceded us, and has gone on that track as far as his own purposes required. A vast deal of sterling talent and precious time is thrown away in re-inventing what has been already invented and applied, if we did but know it—and a vast deal of mortification is felt in finding that what we had worked so hard to secure as our own should after all belong to some professional brother who had got the start of us. And as no verbal description of a work is good for much unless illustrated by drawings, these should always be furnished; but as the making of drawings to a scale and in such style as would be creditable to the contributor as a draftsman would generally consume more time than he could command, it should be sufficient for him to send to the Journal a rough sketch exhibiting all the necessary views of the subject, with the required dimensions and explanations, from which a drawing might be made by the professional draftsman in the employ of the establishment and who should be a person of more than ordinary intelligence and skill.

Failure as well as success in constructed works should be communicated to the Profession through the Journal. The experience derived from failure has often been truthfully said to be more valuable than that drawn from success. The latter makes us often too bold; the former keeps us in salutary check and indicates what we are to shun. The making of these experimental defects known to the world will indeed prove the most difficult of our tasks, and will call for much ingenuous candor on the part of those whose misfortune it has been to do that which has undone itself. And, if that high degree of frankness cannot be practised by the authors of the abortive plans, others, who are witnesses of their want of success must not hesitate to report it for the common benefit, however invidious the office. This should be done of course in the most delicate way and the imputation of personal blame be avoided if possible.

Such are some of the general principles which should govern us in the conduct and support of the periodical which should be established as the organ of our profession and the repository of its theory and practice as developed by the united science and experience of the Civil Engineers of the United States.

Now in the execution of this proposed plan of systematizing our epistolary intercourse with each other on professional subjects, how should we proceed? A few suggestions will essay an answer to this question.

First—we might set up an entirely new Journal, or *second*, we may select for our purpose one of those already in existence.

Difficulties attend both plans; but the most serious I think surround the former, as it would require another convention of Engineers, the assembling of which would be next to impracticable. Better then undertake the office, invidious though it be, of choosing between the papers now established, and proceed to reorganize and enlarge the one which may be chosen, to suit the object we have in view. The two principal periodicals devoted to the subjects of our profession are the "Journal of the Franklin Institute," and the one from whose pages I am now speaking. Upon either stock might be engrafted the improved scion whose cultivation we propose. In regard to the Railroad Journal it is but fair to say that its original establishment was a generous enterprize, which has been poorly rewarded in the hard struggle for existence which it has maintained for the past twelve years. This publication possesses interest in the fact that its birth and that of the railroad system were simultaneous and their existence thus far coeval. I say nothing of the past conduct of this Journal, except that in the feeble support, professional and pecuniary which it has for the most part received, an excuse might be found for a much less spirited and able management than has marked its course.

Of the Journal of the Franklin Institute I need say no more than that it is a paper whose high reputation, enjoyed ever since its institution fifteen years since, is most fully merited. This periodical has possessed a great advantage over those conducted by individual enterprize, in being the organ of a scientific institution whose members have individually and collectively contributed to its support, and whose funds have supplied the occasional deficiencies of its subscription list. By these means it has been enabled to sustain itself and its publication has been uninterrupted and regular. Without being backed by the resources of the society with which it is connected, I am informed, however, that it must have failed for want of pecuniary support, which conclusively shows, that no paper of this kind, dependant upon the punctual payment of subscription dues, can be kept up for any length of time, unless it be propped by such a patronage as I trust can be brought to the Journal which is now suggested as the medium of our professional correspondence.

Between these two publications, it seems to me, our choice must lie. They are published in the two chief cities of the union, with almost equal advantages of position in all respects. I shall, as an individual be satisfied with the selection, let it fall upon either of the two; but upon *one* it must, I think, be definitely settled; for they cannot serve together in the office proposed. The necessity of unity in the organization suggested, is manifest. Interrogatory and reply must pass through the same channel. The article and the criticism of it must appear on the same pages. Of this an illustration was furnished in a number of the Railroad Journal published some months since, in which an author complains that his composition, having first appeared in the Franklin Journal, was commented upon in the other, leaving the separate readers of each acquainted only with the *pro* or the *con*, (as the

case might be) of the question discussed, instead of having both *pro* and *con* before them in one view. Besides, it is essential to the unity and harmony which, it is believed, would be imparted to the actions and relations of the profession, that but one centre should exist from which the beams of intelligence should be radiated or reflected to every point of the professional circle of knowledge. To borrow a geometrical metaphor, the ellipse, with its two foci, would not, it is thought, be the right figure for the purpose. At the same time I must not be understood as presuming to insinuate that the one not chosen for this purpose is to become extinct or to be less active and useful in the course of scince than it may be at present.

The practical difficulty of a selection between these two periodicals or any others that may be named, may however, and in truth does, appear rather appalling. Upon the scheme presented no such concert of action as would attend the proceedings of a convention can be expected. Every individual Engineer whom these suggestions may reach and who thinks them worth acting upon, must express his opinion and cast his vote in the dark. This will be the condition of the question at first; but should there be as it is earnestly hoped there may be, *a general expression of the sentiments of the members thereupon*, light may soon arise out of the darkness, and the conflicting currents of the opinions at first expressed may ere long take a decided set in a direction which shall indicate what is the mind of a majority of the Profession in the matter. From chaos order may come forth. I apprehend more danger from apathy than from anarchy in the republic.

Let us then suppose the effervescence of opposition to have subsided and the "Organ" to be agreed upon. Now to support it upon the principles above developed we must make up our minds to pay well for it. And this we can afford to do, if we consider what the expense would be of attending even the annual meetings of a society, in the place of which our subscriptions to the Journal would stand. Every Engineer who would, if a society were not, (for other reasons) impracticable, attend its meetings and spend from $50 to $100 per annum in doing so, would cheerfully contribute the one-fifth or two-fifths of those sums to a Journal, *if he believed it would accomplish as far as the case permitted, the object of such a society.* Of the extent of this class of Engineers I have no means of accurately judging, but will suppose it might number 100—whose aggregate subscription at $20 per annum would amount to $2000. And further, may not the Profession for the purpose of estimating the revenue of such a Journal, be divided into classes? and, if this be allowable, we may then suppose a second class (I speak in no spirit of invidious comparison) which would pay $10 per annum each, and which might number 200, and, if so, would bring in a further sum of $2000. A third class, consisting of men of general science and information, not having a sufficient interest in the work to go to the same lengths in its support as professional Engineers, might pay $5, and as this class would be a pretty large one we might set it down at 500, in which case it would yield $2,500 per annum. A fourth and final class

might be presumed to consist of contractors, operative mechanics and others who might not, on the whole, be willing to give more than $3 per year; and if they amounted in number to 1000 more, would contribute $3,000. The sum of the contributions of the four classes would then amount to $9,500 per annum. The number of subscribers, supposed as above to be 1,700, divided into this assumed revenue, would give $5·59 as the average subscription for each person. Now although I have assumed the preceding numbers almost at random, they have brought out a result but a little within the subscription price ($6 per annum) of just such a periodical as I have in view, viz: the British "Civil Engineer and Architects' Journal." If that price be sufficient for such a work in England, it would be so, *a fortiore*, in the United States, where books and printing of every kind are much cheaper.

Now it may appear to my readers that this graduation scheme is, at best, a doubtful one, and that no Engineer, however warm his professional zeal and full his professional pocket, would be content to pay $20 or $10, or even $5 for what another class of subscribers got for $3; and this may be so, though I do not think it ought to be so, if the great object in view is exclusively regarded, and fully appreciated, that of maintaining the only or the best substitute for the admitted desideratum of a society of Engineers, at an expense, not one-fourth as great as the latter, even to the most liberal contributor to the "Organ," holding its place. The only way I see to get over this stumbling stone would be to furnish each subscriber with a number of copies proportional to the amount of his subscription; and to do this there must be issued as many as the lowest assumed subscription of $3 would produce by dividing it into the supposed aggregate receipts of $9,500. This would give a quotient of 3166 as the necessary number of copies, or in round numbers 3200, of which each $20 subscriber would get 8 (throwing off the fraction of $\frac{2}{3}$)—each $10 would receive 4 (throwing off the fraction of $\frac{1}{3}$) and each $5, be furnished with 2 (adding the fraction of $\frac{1}{3}$) and the remainder with a single copy each. Then the question is, could 3200 copies of such a Journal be issued for the sum of $9,500?

To enable me to answer this question I have obtained the assistance of a person of experience who has prepared for me a detailed estimate of the annual cost of publishing a periodical (such as I had in view) of 32 pages per month of the form and size of the "Civil Engineer and Architects' Journal," and to be executed in equally good style and as fully illustrated with engravings. The estimate is as follows, for the monthly publication of 1500 copies.

Mechanical department, viz.

Composition, press work, paper, covering, stereotyping and contingencies,	$2033·08
Publishing department, viz.	
Advertising, commissions, envelopes, postage, porterage, publisher, clerk, etc.,	200·00
Editorial department, viz.	
Editor, periodicals, lithography, cuts and engravings,	350·00
Making the total estimated cost of 1500 copies	$2583·08

This includes $568·32 for stereotyping, and the expense of 1000 copies more from the plates is set down at . . . . . 1679·02

So that the cost of 2500 copies would amount, probably, to . . . . . $8267·10

The cost of stereotyping being here estimated at $1·68—to make up the required number of copies we add 700—which at that rate would amount to . . . . . 1176·00

And the probable cost of 3200 copies would be then . . . . . $9443·10

which is a little within the supposed amount of subscriptions.

But what, it will be said is the **$20**, the **$10**, and the **$5**, subscribers to do with his surplus copies which are but so much waste paper to him? Not so. He may find it easier to get rid of them than might be supposed, and that without committing them to the flames or sending them to the trunk maker. The state of things I have assumed is intended to exhibit only the outset of the scheme. Each subscriber who receives more than one copy becomes at once an agent for procuring more subscribers to participate with him in his burthen. Thus the number of subscribers may ultimately come to equal that of copies published. What cannot be disposed of in this way can be readily parted with to friends at home and abroad, with the pleasure which every professional man takes in such courtesies, and for which also he is usually rewarded by an exchange of something of more substantial value to him than even the satisfaction of the gratuity. Besides the value of the "back numbers" of such a work as would be the offspring of the system proposed, would annually increase as the number of subscribers augmented; and sooner or later all the originally extra copies would be absorbed by purchases to make up complete sets of the publication.

I now respectfully commend the subject to the attentive and *early* consideration of the Profession, in the earnest hope that it may be taken up and discussed with an animation indicative of a general and cordial interest in what so vitally concerns our wellbeing as a body. I owe it to one of the most frequent and valuable contributors to our professional literature (John C. Trautwine, Esq.,) to acknowledge his suggestion of the idea upon which I have enlarged, contained in a note to a communication of his which appeared a year or two since in the Journal of the Franklin Institute—and I trust to find in him a zealous promoter of the plan. At the same time it is due to myself to say that the design of an epistolary association acting through a medium such as I have described, occurred to me soon after it became apparent that a society of the ordinary organization could not be formed; and that the first paragraphs of this article were penned at that time and afterwards neglected, under the press of other engagements. In the canvass of the subject which I trust this appeal will produce and in the criticism to which it may be exposed I deprecate nothing but the indifference which would permit the scheme to sleep without a persevering effort on the part of the Engineers of the United States to realize the benefits it may be capable of conferring.

BENJ. H. LATROBE,
Civil Engineer.

Baltimore, Oct. 10, 1843.

For the American Railroad Journal and Mechanics' Magazine.

COST OF TRANSPORTATION ON RAILROADS. BY CHARLES ELLET, JR. CIV. ENG.

(Continued from page 26 Vol. I, Third Series.)

The importance of ascertaining the expense of transportation on railroads, to a large portion of the population of this country, has led to many discussions, and many inquiries, with a view to its determination. No general method has, however, yet been produced, by which it can be ascertained with any tolerable degree of accuracy. The difficulty appears to have arisen, in a great measure, from the fact, that these expenses consist in a variety of elements, which increase and diminish in value by different laws, and at rates which depend on the combinations of these elements in each particular case. It has, also, to some extent, grown out of the fact, that during the progress of this system, every year has produced some new work of improvement, which has supplied new data to calculators—and, unfortunately, data which have preceded the effect of the two greatest causes of expenditure—the destruction consequent on use, and natural decay. Without referring to another difficulty—the extravagant estimates of the friends of particular projects, and, sometimes, the gross misrepresentations of the enemies of others—we see that the subject is much too complicated to be unravelled without close study, and mature reflection. To make a general solution, we have, obviously, to allow for differences of grade, differences of tonnage, differences between the amounts of travel, and have due regard to the length, and even the age of the improvement.

Now, to attempt to go through this whole subject, and produce and analyze the data on which are founded all my conclusions, would require much more labor than I have a disposition, at this time, to appropriate to the question. What I now propose to do, is again to point out the LAW which governs railroad expenditures, and to fix, with greater accuracy, the values of the constant coefficients than was practicable when I first offered the formula which are here repeated.

It is my intention to submit, in the first place, the law which governs the expenditures on a *new road*, and attempt to offer a reasonable explanation, and a just estimate, of the difference between the expenses incident to a new road, and an old one. If my method be true, the reasons, and the values which I assign for this difference, must be obviously just. The general law must first satisfy the mind, and the law of increase, in passing from a new to an old road, must likewise be rational and convincing. If, after this preparatory evidence, I bring forward a certain new road of great length, and show that the calculated cost corresponds well with the actual result, it will certainly be a strong confirmation of the general correctness of the method. But still, for a prudent man proposing to risk his fortune, this alone ought not to be sufficient. This particular example might be selected because it was accidentally found to suit the object; he would have a right, therefore, to call on me to produce a *short* road, and show that the results still correspond with my calculation. His intellect might not yet be fully satisfied; it would be fair for him to call for another example, in which the trade and travel

were both unusually great, in order to be assured that the method is applicable to works of that character also; and, even after finding this result to be confirmatory of the method, extreme prudence would dictate an additional application to another road with very small trade.

All this appearing satisfactory, he could not well retain a doubt; but, when men stake their fortunes, and the comfort and indulgence of their families on the issue, they have a right—they are bound—to exercise great circumspection. Such a party might, therefore, well call for an application of the method to an *old road*—or to one that has arrived at maturity, at least—in order to see whether his investment is likely to be permanently good.

If this doubt be also satisfied; if he finds that the application may be safely made to a road of this description; if, in addition, it is made to one of this sort with a great trade—next, to one with a small trade—then to one with great travel and no tonnage; afterward to a long one, and, finally, to a short one; to some roads with light, and to others with heavy grades—and, if he find that it gives consistent results in all these varied applications—as a reasonable, and as an intelligent man, he will be compelled to admit, that the method is in accordance with THE LAW, and that its results are the TRUTH.

It is such testimony that I propose to offer the reader, and I solicit his attention in order that he may judge fairly of my consistency—for consistency a test of truth. The following propositions are what I designate as Laws:—

I. The cost of motive power, with engines of the same class, is proportional to the distance which the engines run. The cost per mile is *nearly* the same on roads of all grades*—the difference in expense on roads with different grades, consists not essentially in variations of the cost *per mile run*, but in variations of the number of miles which must be performed to do the same duty.

II. The repairs of the road, with equal trade, are proportional to its length; that is to say *cæteris paribus*, it costs twice as much to keep up a road 200 miles long, as it does to maintain one in the same condition, of which the length is 100 miles; just as it costs twice as much to run engines 200,000 miles, as it would to run the same class of engines, 100,000 miles.

III. The repairs of cars are proportional to the number of tons conveyed, and to the distance to which they are conveyed. It costs twice as much to repair cars which run two millions, as it does those which run one million of miles per annum. Again, it costs twice as much to repair cars which convey 20,000 tons a given distance, as it does those which convey 10,000 tons the same distance. The same principle applies equally to the conveyance of passengers; it applies also to accidents, incidentals, and contingencies—for these things increase with and are proportional to, the increase of business.

* The cost per mile run, with engines of the same class is nearly the same on roads of all grades, but if the engines can obtain full trains, or as much as they can carry, the cost per mile run will be somewhat the greatest on those roads which have the most favorable grades. The cost per mile run will be greater on the Reading road than on any other road in the United States on which fuel is obtained at the same rate. The aggregate cost per mile run—i. e. the aggregate expenses for the year divided by the number of miles travelled, if the work is economically managed, will be likewise greater on this road than on any other, of the same age, in this country.

These may appear like self-evident truths, and they are, in fact, so glaring that they scarcely appear to have been looked on at all. The custom now is to regard the expense of cars as proportional to the distance the *engine* runs. It is here made proportional to the distance the *cars* run. It is customary also to consider the repairs of the road as proportional to the distance travelled by the engine—whereas it is only proportional to the length of the road.

These are simple principles, and such as cannot well be doubted, or denied. It remains to state the values of the constants.

REPAIRS OF ROADS.

The repairs of a railroad, I have stated, must be divided into two classes—those which are dependent on, and those which are independent of, the amount of the tonnage. Of the first division, the wear of iron depends entirely on the use, and the wear of the wood, but partially on the use. The rotting of timber, the cleaning out of ditches, the repairs of culverts, embankments, etc., are independent of the trade. But these items are not independent of *time;* the expenses of repairs increase but little until the wood in the sills, ties and rails, begins to decay, and require removal, when they usually soon attain their maximum, and afterward diminish, until they reach a second minimum.

The following table exhibits the cost of repairs on six of the most successful roads in this country, which I have purposely selected from different sections. The table embraces three roads of each of the two great classes—three wooden superstructures with plate rails, and three iron roads with T or H patterns.

By casting the eye down the columns, the progressive increase of expenses will be easily recognized. It must be borne in mind, however, that these numbers do not include the renewal of the iron—an item always charged to "extraordinary repairs," or "permanent improvements,"—as though iron rails were ever permanent, or their destruction extraordinary. Eventually, the cost of the new iron passes into capital stock, or funded debt.

Table showing the Increase of the Cost of Repairs of Railroads.

Year.	Permanent road—edge rail.			Wooden roads—Flat bar.		
	Boston and Lowell.	Boston and Providence.	Boston and Worcester.	Utica and Schenectady.	Petersburg road.	South Carolina road.
1836	...	...	...	...	$251	$870*
1837	$546	$285	$206	$354	664	880
1838	611	411	281	330	542	1040
1839	731	209	405	450	539	982
1840	816	334	830	618	794	592
1841	1200	597	784	837	857	547
1842	1350	514	903	935		503
1843						375

I may add the following notes of the cost of motive power per mile travelled by the engines, which are extracted from documents that were not in my possession when I first stated the cost per mile for passenger engines at 25 cents, and of freight engines at 30 cents:—

* Finished in 1833, when the expenses were very low.

Table showing the Cost of Locomotive Power for 1842.

Name of road.	Miles run.	Expense. Dollars.	Cost pr mile	Year.	Remarks.
Boston and Providence,	35,031	11,399	32½	1842	Freight engines.
Boston and Providence,	77,774	23,352	30	1842	Passenger engines.
Western road,	397,295	84,165	21 1/7	1842	Exclusive of wages.
Western road,	397,295	115,000	30	1842	Wages included.
Utica and Schenectady,	155,828	33,454	21½	1841	Exclusive of new eng.
Utica and Schenectady,	155,828	52,268	33 3/10	1841	Including new eng's.
Reading road,	83,717	17,443	20 8/10	1841	With new engines.
Reading road,	198,055	49,800	25¼	1842	New, but heavier eng's

This table entirely confirms the previous estimate [vol. iv, p. 307.] Another table in my possession [derived from reports of 1842] gives for the average value of repairs of locomotives, 7 cents per mile run; my impression is, however, that this item is worth not less than 8 cents, and that future observation will maintain it, for engines that are not fresh from the factory, at about that average.

We may now pass to the method and the rule which I propose for computing the aggregate annual expenses of a road. In the first number of this investigation, I proposed a formula which was published in this Journal, for determining the value of these expenses—stating, however, that there was no line in the country which had yet exhibited results as favorable as expressed by that formula. The present paper is intended to show these expenses *as they are*; the same formula is used, though the constants are modified to suit the actual condition of the system.

FOR NEW ROADS.

The aggregate annual charges on *new roads** are made up of the following items, viz.:—

For every mile travelled by the engines, 24 cents; for every ton conveyed one mile, 9 mills; for every passenger conveyed one mile, 7 mills; and for every mile in length of the road, 300 dollars, facts which are expressed by the formula,

$$\frac{24}{100}\mathrm{N}+\frac{9}{1000}\mathrm{T}+\frac{7}{1000}\mathrm{P}+300h.$$

where N is put for the number of miles run by the locomotive engines, T the tons nett conveyed one mile and P the passengers carried one mile and h the length of the road in miles.

Now, new engines consume as much, or nearly as much, fuel and oil as those which have been used; and they require the same number of enginemen and firemen. The only reduction in the cost of their maintenance, consists in the item of repairs. The bill for repairs for the first year or two, is only about one-half its mean value; and as the average cost of repairs is about 7 cents per mile run, the aggregate cost per mile run on a road which has passed its fourth year, should be 27½ cents, instead of 24 cents.

The *timber* in the superstructure is worth on the average, from 1000 to 1500 dollars per mile, and lasts from 5 to 7 years. The decay of timber in roads of mature age and provided with a single track, is, therefore, about $200 per mile—so that ordinary repairs on such roads will be about $500 per mile.

The wear of cars after the road has been a few years in operation, is equivalent to about 4½ mills per ton per mile; and on a new road it is scarce-

* I designate as new, roads less than five years old.

ly appreciable. The difference between the perceptible injury to the road and cars, on a new and old road, is about five mills per ton per mile. The rule then is—

FOR OLD ROADS.

For every mile travelled by the engines, (passenger engines 25 and freight engines 30 cents,) an average of 27½ cents; for every ton conveyed one mile, 14 mills; for every passenger conveyed one mile, 7 mills; and for every mile of road, $500.

If the principles and the values here offered be correct, they will stand the test of trial, and in order to make the test the strongest possible, I will add in a subsequent paper an estimate of the probable results on a road in active operation, and the subject of much speculation at the present time, the correctness of which estimate can be verified at the end of the year.

This rule, if applied to the business of a line in activity, will give only those expenses which are usually denominated "ordinary expenses." In order to arrive at the *true cost* of maintenance we have to add, of course, the extraordinary expenses, which we can likewise estimate with some, though not very great, accuracy, by data now supplied by the improvements of the country.

APPLICATION OF THE FORMULA TO ACTIVE WORKS.

I shall apply this method of computation, in the first place, to a railroad in Georgia, 147½ miles long, with easy grades and little business; next, to one in Massachusetts, 156 miles long, with grades of more than 80 feet to the mile, on which the engines travel nearly four hundred thousand miles per annum, and where the trade and travel are both great; I will then apply it to a short road in the State of New York, which carries no tonnage at all, but which derives its revenue entirely from passengers, and which has moderate grades, and a moderate business; next, I will make the application to a road in Maryland 70 miles long, with grades of 84 feet, and which derives two-thirds of its revenue from tonnage. Finally, I will apply it to a road in Pennsylvania 56 miles long, with favorable grades and moderate business—and again to the same road the next year, when extended 38 miles further, and having an increase of business.

The following table gives the length, grades and business of these roads; and, in the two last columns, are placed, side by side, the actual and calculated expenses.

Table exhibiting the actual and computed cost of maintaining new roads, calculated from the formula,

$$\frac{24}{1000}N+\frac{9}{1000}T+\frac{7}{1000}P+300h.$$

Name of road.	L'ngth miles.	Grade in feet.	Miles trav. by engines	Through tonnage.	Through travel.	Expenses. dollars.	Calculated exps. dolls	Year.
Georgia road,	147½	37	152,873	10,000	12,000	109,819	106,605	1842
Western road,	156	83	397,295	40,000	53,000	256,619	256,187	1842
Syra'se & Utica,	53		84,000		87,881	62,325	68,662	1842
Balt. and Susq.	70	84	128,349	23,000	16,500	75,224	74,379	1842
Reading road,	56	19	83,717	24,000	31,653	62,635	61,318	1841
Reading road,	94		198,055	65,000	33,720	138,900	152,911	1842

The roads named in this table are all those which have been completed less than four years, of which I have been able to procure the trade and travel, aggregate expenses, and distance run by the locomotive engines for the year 1842. In some of these I have been compelled to deduce the through tonnage from the receipts and prices—the reports giving only the aggregate tonnage;—in general the through travel is given with precision.

The agreement between the actual and calculated results in this table, is most remarkable, and exhibits a degree of uniformity in the administration of the lines, which could not have been anticipated. Indeed it is most probably because the roads are so new that the agreement is so perfect. When they begin to feel the effects of time and use, they will give way unequally, and exhibit much wider deviations from the rule. This fact is exemplified in the following table, which exhibits the results of experience on 11 important railroads, selected from different sections of the country. The roads in this table vary in length from 14 miles to 136 miles; in grades from 10 feet per mile, to 83 feet per mile; in freight from nothing to 94,000 tons; in travel from 7,000 to 180,000 passengers; and in expenses from 30,000 to 225,000 dollars per annum.

Table exhibiting the actual and computed cost of maintaining roads which have been completed more than four years, calculated by the formula,

$$\frac{27.5}{100}N+\frac{14}{1000}T+\frac{7}{1000}P+500h.$$

Name of road.	Year.	L'ngth miles.	G'de. in ft.	Miles run.	Through tonnage.	Through travel.	Actual expen's, dols.	Calculated exps. dolls.
Bost. and Prov.	1842	42	38	120,000	21,200	117,129	101,596	100,897
Balt. & Wash.	'41-2	30½		91,428	27,369	114,260	73,684	76,166
Petersb'g road,	1842	61	30	131,160	22,000	16,000	96,398	92,489
Nash. & Low'l,	1841	14	10	44,040	28,663	85,737	30,708	33,131
Balt. and Ohio,	1842	82	82½	299,617	44,477	34,380	220,135	192,925
Ports. & Roan.	1842	79		96,000	5,975	7,662	73,345	76,703
Bost. & Lowell,	1842	26	10	143,607	93,927	179,819	131,012	119,409
Phil. & Colum.	1842	82	45	261,844			116,000	112,979
S. Carol'a. road,	1842	136	35	260,324	27,000	24,000	225,743	213,945
Bost. & Worc'r.	1842	44½	42	241,319	61,911	165,720	168,509	176,815
Utica & Schen.	'41-2	78		152,764		114,527	154,436	143,542

[NOTE.—The miles run on the *Petersburg road* are assumed to be the same as in 1841; the tonnage is estimated from the tonnage of 1841, with an allowance for the increased receipts. The results on the *Baltimore and Ohio road* for 1841 are preferred, because those of 1842 are complicated by the extension of the line to Cumberland. The report of the *Philadelphia and Columbia road* contains only the expenses of motive power and repairs; the freight and passengers are conveyed by other parties; we have, therefore, in the formula to make $P=0$ and $T=0$, for this case. The tonnage and travel on the *South Carolina road* are deduced from the printed reports. The actual expenses on some of the lines will be seen to differ from other published statements; this will be found to arise from the fact that these statements contain charges for interest, ferries, cars and motive power on branch roads, which, of course, are rejected in this comparison.]

Here is presented a list of eleven roads, situated in different sections of the

country, and offering every variety of length, grade and business that could be desired, in order to put the formula to the severest test. The greatest difference which is exhibited in the whole list between the actual annual cost of maintenance, and the estimated cost, *is* 12 *per cent.*; certainly no closer agreement could be expected, since the actual expenditures fluctuate to that extent—and perhaps, through wider limits—from year to year; the removals of decayed timber, and various contingencies, being found much more extensive some years than others. In looking over the list I am able to account, in almost every instance, for these departures from the formula, by my personal knowledge of the situation of the line. It will probably be seen on some future occasion, that those roads which now exhibit expenses above the formula, will fall below it for other years—a remark which is applicable to the Boston and Lowell, Baltimore and Ohio, and South Carolina roads. I hope they may never again rise above it.

It is no part of my object to flatter the expectations of railroad companies, but to exhibit to them and the public the truth. To those companies whose works are now new, and who *seem* to be making money, I would suggest the timely formation of a contingent fund, to prepare them for a contingency which will as surely reach them as the next new year. It is bad policy to divide the *annual expenses* as if they were real profits; the money that is earned at the expense of the rails, cars and machinery, should be hoarded to replace those things, and not distributed, as if they were to last forever. It can be shown that every company should aunually store away, in times of prosperity, while their work is new, at least 6 cents for every mile travelled by their engines, 1 cent for every ton conveyed one mile, and 200 dollars for every mile of road, to replace decayed materials, and injured iron and machinery. If their profits will not permit that reservation, then the prudent man will avoid their stock; and the company should cut down their expenses to the limit assigned by the trade. Where these expenses do not consist of interest on debt, this retrenchment is almost always possible.

In the first of these tables the Reading railroad appears to escape the application of the rule; the calculated expenses exceeding the actual charges, as stated by the company, some $14,000, or about 10 per cent. There has probably been a division made between the current and contingent expenses on this line; indeed, on inspecting the published exhibit, I find that the whole sum set down for *timber* used in repairing 94 miles of road, including rails, sills, etc., is just $2,431. Now, I know personally, that twice that sum would not pay for the timber required for repairing the bridges alone. The bridge account last year must have amounted to more than $12,000, and seems not to be included in the published statement. This sum being added to the published total, brings the year's expenses up to $151,000, or within 1¼ per cent. of the formula. Perhaps the company regard the loss of a bridge as so extraordinary an occurrence, that it can never take place again; but their report already points to another which is found to be "less permanent than the rest;" and time will show that no part of railway

superstructures will long remain permanent under the action of heavy engines and their trains. Besides, there will be freshets, and tornadoes, and fires; and on a road which has a great many bridges constructed of perishable materials, and which is travelled by 25 or 30 locomotives every day, or about 10,000 trains a year—with engines using pine wood for fuel—many such accidents must be expected. One bridge per annum is a small allowance for the average loss; and if the bridges happen to be fortunate, there will be rotten sills or crushed iron enough to compensate for the difference.

We perceive then that the formula applies also to this road; and I will now insert a table exhibiting its application to all the roads of which I have been able to obtain the amount of trade, and annex a column showing the per centage of error for each; not having the number of miles run by passenger and freight engines separately in every instance, I make use of the mean value $27\frac{1}{2}$ cents per mile run.

TABLE.

Name of road.	Year.	L'ngth	G'ds.	Miles run.	Through tonnage.	Through travel.	Actual expenses.	Calculated expenses.	Error per ct.
							Dollars.	*Dollars.*	
Georgia road,	1842	147½	37	152,873	10,000	12,000	109,819	106,605	—2¾
Western road,	1842	156	83	397,295	40,000	53,000	256,619	256,187	0
Syrac. & Utica,	1842	53		84,000		87,881	62,325	68,662	+10
Balt. & Susq.	1842	70	84	128,349	23,000	16,500	75,224	74,379	—1
Reading road,	1841	56	19	83,717	24,000	31,453	62,635	61,318	—2
Reading road,	1842	94	35	198,055	65,000	33,720	151,000	152,911	+1¼
Bost. & Prov.	1842	42	38	120,000	21,200	117,129	101,596	100,902	—$\frac{3}{4}$
Balt. & Wash.	'41-2	30½		91,428	27,369	114,260	73,684	76,193	+3¼
Petersburg road,	1842	61	30	131,160	22,000	16,000	96,398	92,310	—4
Nash. & Low'll,	1842	14	10	44,040	28,663	85,737	30,708	33,131	+8
Balt. & Ohio,	1841	82	82½	299,617	44,477	34,380	220,135	192,925	—12
Ports. & Roan.	1842	79		96,000	5,975	7,662	73,345	76,703	+5
Bost. & Low'll,	1842	26	10	143,607	93,927	179,819	131,012	119,409	—9
S. Car'lina road,	1842	136	35	260,324	27,000	24,000	225,743	213,945	—5
Bost. & Worc'r.	1842	44½	42	241,319	61,911	165,720	168,509	176,831	+6
Utica & Schen.	'41-2	78		152,746		114,527	154,436	142,542	—8
Phil. & Colum.	1842	82	45	261,744			116,000	112,979	—2¼
Aggregate,		1251		2,886,292	Tns 1 mile 33,360,560	Pas. 1 mile 58,633,722	2,109,188	2,074,512	

NOTE.—[By "through tonnage" and "through travel," is to be understood the whole number of tons and passengers carried one mile, divided each by the length of the road in miles. It is much to be regretted that companies do not give these facts in their annual reports.]

One word more in reference to this table. I offer here a list of 17 railroads, presenting almost every conceivable variety of length, grade and character. It is not a *selected* table, but contains the results of one year's operations on *every* road, without exception, concerning which I have been able to obtain the necessary data---materials which have only been procured by dint of great exertion. It will be seen that the management upon these various lines is very nearly uniform, and that they are *all* obedient to the *law*. The greatest departure from the formula is 12 per cent.

Now, this list embraces roads which are situated in every one of the seaboard States from Maine to Georgia; the aggregate length of line exhibited is 1251 miles; the engines traverse annually a space of 2,886,300 miles, and they carry no less than 33,360,560 tons, and 58,633,722 passengers 1 mile. The aggregate ordinary expense of maintaining this length of line, and accommodating this amount of tonnage, is actually $2,109,188 annually, and the calculated expense $2,074,512. The difference between the calculation and the fact is $34,676, or less than two per cent.

I conceive, therefore, that I have authority sufficient for announcing this formula as expressing the general law of railroad expenses---a law to which all the roads in the country are obedient. If stronger evidence of its correctness could be offered, I know not in what it would consist.

It is in vain to urge here that a certain road has peculiarly steep, or peculiarly light, grades, which should exempt it from the application of the rule. The formula which I announce, accounts for these differences. When the grades are easy, the engines make fewer miles, and the rule looks only to the miles.

There is yet another point of great importance connected with this subject, which ought not to be overlooked, viz., the "extraordinary expenses." It is the custom among too many of the parties interested in the railroads of this country, to look upon the suggestion that iron may be worn out, as a thing so chimerical and visionary, as to be entirely unworthy of their sober thoughts. In the course of a few years they are surprised by the fact---the certainty---that money must be raised, for that their iron must be renewed. Instead of being warned by experience, and commencing immediately the work of retrenchment, and the provision of a surplus fund to meet the recurrence of the contingency, they look upon it as extraordinary in the extreme---a sheer accident, which cannot occur again, or which can be warded off by a heavier iron. Experience and common sense teach that heavier iron will be attended with heavier expense; but they have *not yet* taught that the wear will be less. A heavier rail may longer resist a given trade; but will each dollar put into the heavy rail go farther? This however, is a subject which must be reserved for a future number of the Journal.

(To be continued.)

The following communication from Mr. Whittle is worthy of consideration. Whatever changes in the details of his plan circumstances may dictate, the general principle is a good one and should be in more frequent operation than at present. The suggestions of Mr. W. are not *trifling* and we should be most happy to receive many more such *trifles* from him and from others of the profession.

For the American Railroad Journal and Mechanics' Magazine.

In my last annual report to the Monroe railroad company, of Georgia, I proposed the following remarks, which if carried into use, I feel confident would add much to the present prosperity of railroads and advance the interest of their owners.

1st. To encourage planters, who forward their freight, also to travel on the road, give them $\frac{25}{100}$ of the amount of their *freight paid*, in tickets, which tickets will be received for the fare of themselves and families during the year in which they are issued, one-half being paid each time *in cash*. Thus, A sends freight over the road, amounting to $100, which he pays in cash; the railroad company then furnish him with tickets to the amount of $25, which will be received from him or his family for *fare* when they travel, one-half the fare each time being paid *in cash*. The tickets should not be transferable and if not used the year in which issued, should be void.

2d. Many of our roads, in the south at least, have been under weigh for years, without paying the shareholders any interest; during which time, they have had to pay customary charges when they have used it in any way. I would propose that tickets be furnished them each year, till their investment pays an interest to the amount of one-fourth of the interest on their stock, which would be received as above, and that they might also apply to freight on goods as well as fare for passage, which alone was intended for the planter.

I speak from experience and feel very confident that these two suggestions, trifling as they may seem, if carried out, will add greatly to the use of public works and receipts of the companies, especially when the stock is owned by persons living along the line of road. The proportions to be given in tickets, of course, would be varied to suit each case.

September, 1843. L. N. W.

For the American Railroad Journal and Mechanics' Magazine.

Messrs. Schaeffer & Minor,

The article under the head of "Revolving Steamer," in the September number of the Railroad Journal, describes, I think, not exactly but very nearly a machine which was invented some years since by J. N. Pomeroy, Esq. of Burlington, Vt., a description of which he communicated to, and was published in the Railroad Journal. I do not recollect the year, but it was near the commencement of the Journal. If upon examination you consider me right in my conjecture, I will not insist on your "yielding the editorial pen and scissors," provided you will apprise the New Orleans inven-

tor through your columns that he has probably been anticipated in his discovery. FULTON.

This communication came to hand too late for a reference to the article referred to. A notice will appear in the next, and if our correspondent thinks he has the better of us we *will* yield him our editorial "pen and scissors."

ENGINEERING.

We learn with pleasure that Mr. *Edwin F. Johnson*, and Mr. *William R. Casey*, Engineers well known to the readers of the *Journal*, have established an office in this city where they will devote their attention to the numerous works which *ought* to fall within the range of the Profession, and which indeed constitute its main occupation in Europe.

Strange as it may appear, there is not an office in this city where persons can obtain the advice and assistance of experienced Engineers in the numerous instances where such aid is obviously wanted. These subjects are alluded to in the circular, a copy of which accompanies this number, and again more briefly in their advertisement.

We called attention sometime since to this view of the duties of the Profession and still believe that, by making proper exertions throughout the country, all its *permanent* members would soon find profitable and steady employment. Nothing would conduce more to this desirable end, than the simultaneous establishment of similar offices in all our main cities by men of undoubted skill and character. We shall be happy to give all the assistance in our power to increase the usefulness of the Profession, and hope soon to see the advertising columns of the Journal adorned with similar notices of Engineers in different parts of the country bringing their claims prominently yet fairly before the community.

IRON STEAMER ON LAKE ERIE.

We extract the following from a letter recently written to a friend in this city by a young gentleman in the service of the government, from Erie, Pennsylvania.

"Our iron steamer is fast progressing. I was really surprised at the foresight and ingenuity of Mr. Hartt, the constructor. Nothing came amiss, all the 100,000 holes fitted, and very few indeed were to be drilled. One would think he had built fifty iron vessels instead of this the first. The strains are all counteracted with great judgment, and in reading works on the subject, published since she was drafted, there are some new suggestions which he had before adopted."

It would gratify us if Mr. Hartt or the young gentleman above alluded to would send us, for publication in the columns of the Journal, a detailed description of the plan of construction of the steamer mentioned, and the machinery connected therewith; also a description of the performance of the vessel when put afloat.

Information of this description cannot at the present time be too widely diffused.

ACCIDENTS UPON RAILROADS.

In our number for September, I took occasion to refer, in a manner somewhat pointed, to the frequent occurrence of accidents upon railroads. To those who have been familiar with the course of this Journal in relation to the railroad cause, during the past twelve years, I deem it altogether unnecessary to say more than that those remarks were made with a single eye to the *safety* of those whose business places them within the reach of injury from such casualties, and of course, therefore, to the *interest* of the proprietors of railroads. There was no intention to single out any particular road for censure, but to speak of the most recent accidents as the information before the public seemed to call for, with a view, or in the hope of calling that attention to the subject which its vast importance imperiously demands. Whether they have had the desired effect to arouse the attention of others who have experience in the management of railroads, and the ability to point out the *cause* and suggest a *remedy* for accidents, or not, is now of little importance, inasmuch as the subject has been taken hold of by one who is evidently familiar with it, as will, I think, be seen from the communications signed "T," in our last, present, and succeeding numbers, having now two numbers in hand, which we received too late for this number, from the *Balt. Amer.*, to, and upon which, we ask the special attention and comment of our readers. Let those whose interest is so intimately connected with this matter give it their early attention, and if need be, apply to their respective legislatures for such additional laws as may be necessary to prevent the remaining of cattle upon railways, for the right of way for which, most of the companies have been compelled to pay more than the value of what they occupy. Let the travelling community also, who have what may be termed a *life and limb* interest in the establishment of a thorough system of police for the management of, and prevention of accidents on railroads, urge upon their representatives the *necessity* of such laws as will secure its safety and protect the rights of those who have invested their capital in the construction and management of railroads; an investment which has thus far at least, contributed far more to the interest of those who are *not* than than those who *are* stockholders. D. K. M.

The letting of the Mad river and lake Erie railroad, from Tiffin to Carey —a distance of 16 miles—took place on the 26th ult. We learn from the Urbana Citizen that the contract for the entire work was given to Mr. Reed, of Tiffin, at $48,000—about $3,000 per mile.

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